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SOME FACTORS AFFECTING AN ACCIDENT-PREVENTION PROGRAM IN METAL MINING IN CALIFORNIA

BY

S. H. ASH AND EMORY SMITH

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DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

SOME FACTORS AFFECTING AN ACCIDENT-PREVENTION PROGRAM IN METAL MINING IN CALIFORNIA[1]

By S. H. Ash[2] and Emory Smith[3]

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INTRODUCTION

California leads the Nation in the number of operating metal mines and the small number of persons employed at individual mines, which reached a minimum in 1932 with an average of seven men. The mines are scattered over the entire State, which is the second largest in area (155,562 square miles) in the United States. The mines are situated at various altitudes, with portals ranging from approximately 300 feet below sea level to almost 12,000 feet above. Many of the mines can be reached only during the summer, while at others the heat of the desert regions adds to the difficulties during the summer months. Supplies of explosives, the use (or, probably more correctly, the misuse) of which constitutes one of California's gravest mining problems, are handled and stored under conditions that contribute many hazards. The problem of providing medical care is serious and complicated, especially at small mines and more particularly in the almost inaccessible mountainous regions; instances in which a knowledge of first aid would have been beneficial but was lacking, or when first aid was instrumental in saving life or limb because it was available are too numerous to be mentioned.

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[1] The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6909."

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The majority of those who attend first-aid classes already have completed a day's work and are tired; therefore, to obtain results the classes must be so conducted that the men will become genuinely interested in the subject; many miners drive more than 25 miles in mountainous country to reach the classes. Slowly but surely the idea is taking root that it is through the education of the workmen themselves that human suffering and economic loss due to accidents can be eliminated and that a well-grounded knowledge of first aid not only prevents much suffering after accidents have occurred but also the safety knowledge obtained through taking a good first-aid course is one of the best-known ways to instill safety consciousness in those who take the training.

Table 1 gives the number of mines, number of employees, and the accident frequency and severity rates in California for 1929-34, inclusive.

TABLE 1. - Number of mines and men employed and accident frequency and severity rates for 1929-34 inclusive1/

Year	Number of mines (all mines)	Men employed (300-day workers)	Men employed per mine (all workers)	Rates per million man-hours, killed		Rates per million man-hours, killed and injured	
				Number	Frequency	Frequency	Severity
1929 ..	538	6374	13.8	31	2.03	96.68	14.582
1930 ..	476	4962	12.4	29	2.43	120.91	17.814
1931 ..	640	4453	8.7	15	1.39	109.24	11.454
1932 ..	817	4172	6.9	25	2.49	94.91	17.535
1933 ..	973	5511	8.1	9	0.68	120.13	7.326
1934 ..	1227	7254	8.1	26	1.50	117.19	12.048
1929-33	2/689	2/5103	2/9.0	3/109	2/1.78	2/108.39	2/13.569

1/ Compiled from Bureau of Mines reports on metal-mine accidents in the United States.
2/ Average.
3/ Total.

Increasing accident cost in California during 1931 led to an exhaustive study in which representatives of the United States Bureau of Mines and the State Industrial Accident Commission participated with the mineral committee of the California State Chamber of Commerce under the direction of Frank H. Probert, chairman. It was concluded that something had to be done to prevent accidents at the smaller mines and that such mines should receive some financial remuneration for this purpose. On January 9, 1932, representatives of the United States Bureau of Mines and the State Industrial Accident Commission jointly recommended to the California Inspection Rating Bureau that a discount in insurance rates be allowed to mines that complied with certain safety educational requirements. This recommendation was approved, and on April 12, 1932, a safety plan was adopted as part of the California rating system.

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MINE-SAFETY ORGANIZATION AND CREDIT PLAN

By complying with the mine-safety organization and credit plan and filing the proper application, a discount of 1 to 12 percent of the mine rate can be obtained on insurance rates.

Eligibility

The plan applies only to employees in the mining classifications. To be eligible for credit, the mining payroll must be large enough to develop a $500 annual premium computed at basic mine rates.

Prerequisites

The prerequisites for credit are:

(a) The Industrial Accident Commission Mine-Safety Orders must be complied with.

(b) All employees must wear safety shoes of the box-toe type.

(c) All employees engaged in breaking rock and drilling and blowing out holes must use glass-lens goggles (not laminated) or wire-mesh goggles of at least 20 mesh, and it is recommended that these goggles be worn by all other employees wherever necessary.

(d) All employees must wear safety-type hats, which shall provide protection for the head, ears, and forehead and be electrically nonconductive and nonflammable, and which shall also be provided with a suspended inner crown so that the major impact from a falling object will be absorbed principally by the suspended inner crown.

How to Obtain Credits

Credits are obtainable for first-aid training, safety organization, maintenance of a mine rescue-station, or any combination of these.

First-Aid Credit Requirements

When all employees have been trained in first aid and certified by the United States Bureau of Mines, a credit of 5 percent of the basic rate will be granted immediately. When all the employees have not been so trained, smaller credits may be obtained in proportion to the number trained, as follows:

80 percent of the men trained	4 percent credit.
60 percent of the men trained	3 percent credit.
40 percent of the men trained	2 percent credit.
20 percent of the men trained	1 percent credit.

Safety-Organization Credit Requirements

For full compliance with this section a credit of 5 percent of the basic mine rate will be granted, effective 60 days after organization begins.

The safety organization shall comprise a "safety committee" of at least four men, including the mine superintendent and at least one man who has the necessary qualifications for "safety inspector". Large mines and mines working more than one shift should select more men as inspectors, depending on conditions.

(a) Safety inspector. - The men chosen to be safety inspectors may be regular employees, but they must have had 5 years experience in underground mine work and must hold United States Bureau of Mines certificates of first-aid and mine-rescue and protection training.

The safety inspectors may have other consistent duties, but they shall inspect each working place not less than twice during each shift and shall keep a record of all inspections, which shall be submitted to the Safety Committee at each meeting. All unsafe conditions found shall be corrected immediately, and any non-use of head, foot, and eye protection shall be reported to the committee with a statement of the corrective action taken.

(b) Safety committee. - The safety committee shall meet twice each month and at intervals of not less than 12 days. At these meetings the committee shall consider and act upon all recommendations for mine improvement made by the safety inspector, by members of the committee, and by mine employees. Minutes of these deliberations shall be kept. Two copies of the minutes shall be sent to the insurance company and one copy to the owner of the mine each month. (The insurance company will forward one copy to the California Inspection Rating Bureau.)

The minutes shall include a report of investigation of all accidents that have occurred since the previous meeting, and recommendations to prevent recurrence of them. The minutes shall also show the accumulated total number of safety recommendations made by the mine safety committee and safety inspector, and the number of them that have actually been carried out to date.

The entire safety committee shall make a complete tour of inspection of the mine property every 60 days. A complete report of each inspection shall be included in the committee minutes.

Mine Rescue Credit Requirements

If a mine rescue-station is maintained on or near the mine and is equipped to meet the standards of the United States Bureau of Mines and written approval of the station is given by the Bureau of Mines, a credit of 2 percent of the basic mine rate will be granted immediately.

Form of Application for Safety Organization Credit

Employer.
Location.
Number of employees (underground operations).
Number of employees (surface operations - not ore milling or smelting).

1. Payroll per annum (mine employees - underground and surface)
2. Are Industrial Accident Safety Orders enforced?
3. Do all mine employees wear box-toe safety shoes? Safety hats? Goggles?
   (a) Do safety hats provide protection for the head, ears, and forehead?
   (b) Are safety hats provided with a suspended inner crown?
4. Inception date of safety organization.
5. Members of safety organization committee and positions held.
6. Dates of committee meetings.
7. Number of recommendations submitted from inception date of safety organization.
8. Number of recommendations carried out.
9. Date of safety committee inspection tour of mine property.
10. Name of safety inspector.
11. Duration of experience of safety inspector in underground work.
12. Does safety inspector hold certificate of U. S. Bureau of Mines in first aid and mine rescue and protection?
13. Does safety inspector inspect each working place twice each shift and keep record of such inspection?
14. Number of men trained in first aid and certified by the Bureau of Mines.
15. Is mine rescue station maintained and equipped according to the standards of the U. S. Bureau of Mines?

FIRST-AID AND SAFETY WORK OF THE UNITED STATES BUREAU OF MINES

Adoption of the safety plan has given decided impetus to the demand for the first-aid and accident-prevention courses of the United States Bureau of Mines. The program is being directed along several fronts, the primary object being to educate all personnel at each mine in methods of accident prevention. Training in first-aid principles and mine rescue operations at fires and explosions forms a basis for the discussion of accident-prevention measures. Safety talks and accident-prevention lectures illustrated by lantern slides are helpful features of the program.

For some years before 1932 these phases of the Bureau's work were not emphasized at California mines, and the problem of interesting the mining personnel was difficult. This condition is illustrated better by statistics of the number of men trained by the Bureau in 1931 and succeeding years, as shown in

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table 2. Any wise manager knows that the more calls that are made by his salesmen the more business he is likely to obtain; this is also true in safety work, and the more calls that are made on the job by the management, officials, and safety-education agencies in the interest of safety education the more fruitful and remunerative the results are likely to be.

Data in table 2 indicate that there is a large field for safety education at California mines; at present this is largely in the hands of the industry itself. According to the table, approximately only one third of the men employed in 5 percent of the mines are receiving the simple fundamentals of first-aid education through the United States Bureau of Mines, and the indications are that most of these men have never had any training along this line. A study of individual mine reports shows that approximately 80 percent of the total number of mines have fewer than 19 employees.

TABLE 2. - First-aid training statistics at California mines,[1] 1931-35, inclusive

Year[2]	Companies awarded 100-percent certificates in first aid[3]		Men trained at mines		Total mines and employees in State	
	Number	Men employed and trained	Number	Men employed	Number	Men employed
1931	2	372	5	510	640	5553
[4]1932	10	1437	17	1631	817	5646
1933	12	1402	39	2037	973	7892
1934	22	2327	59	3493	1227	10076
[5]1935	26	3226	57	3802	([6])	([6])

[1] Bureau of Mines classification.
[2] Yearly period, July 1 to June 30.
[3] Mines employing 25 or more men.
[4] Safety Credit Plan adopted.
[5] 10 months, July 1, 1935 to Apr. 30, 1936.
[6] Not available.

The United States Bureau of Mines issues, and renews annually to mines that employ 25 or more persons and meet the requirements, a certificate of 100-percent first-aid training, and records are kept on that basis. Since 1929 the average mine in California has employed but nine men, and until recently it was not possible to ascertain the number of mines at which all men were trained. Records show that many small mines send one or more of their employees to classes held at the larger mines. In some instances a group from a number of small mines is formed to take the training, and it is not unusual to find persons traveling long distances for this purpose.

Under the safety plan now in effect the district engineer of the United States Bureau of Mines certifies the following data to the California Inspection Rating Bureau: Number of persons trained and total number employed on the surface and underground and whether the mine rescue-station and equipment available complies with the standards recommended by the Bureau.

During 1935, 47 mines employing 3,779 persons received credits under the rating plan; these represented about 3 percent of the mines and one third of the total number of persons employed by the mining industry in the State. Due to 100-percent first-aid training, 34 of these mines with 3,233 workmen received a refund of 5 percent of premiums paid; 13 mines employing 546 workmen received first-aid credits of 2 to 4 percent; 33 mines received 5 percent additional for safety organization; and 6 mines received 2 percent credit for mine rescue-stations. The total premium saving for this group of mines was approximately $54,000 for 1935.

The significance of the above figures is that 97 percent of the California mines, employing more than 6,000 persons, could effect a direct-premium saving of over $100,000 in addition to the savings that would certainly accrue from reduction in hidden costs, human suffering, and insurance rates. That the mining industry is awakening to this situation is indicated by the fact that by May 1936 the number of mines under the credit plan had increased to 88, representing a total of 5,117 workmen. The need for mine rescue-stations cannot be too strongly emphasized, and the California mining industry could well afford to consider seriously establishing several central mine rescue-stations.

What has been done is an outstanding achievement on the part of the mining industry in California. As shown in table 2, only 510 persons were trained by the Bureau of Mines in 1931 compared with approximately 4,500 in 1935. In 1931 not one standard, central, mine rescue-station existed, while at present four up-to-date stations are available to at least half of the workmen.

Before 1932 the use of head protection in California mines was essentially nonexistent; at present such protection is required for all employees at all but very small mines, and absence of head protection in these is rapidly becoming a rarity.

Recognizing the hazard of open lights as a cause of mine fires and indirectly if not directly contributing to many accidents from explosives, as well as the positive and better illumination furnished by electric cap lamps, two of the larger mines have recently made complete installations of up-to-date electric cap lamps as the portable light for underground workers. A reduction in accidents from falls as well as an increase in the efficiency of the men have been noted in the relatively short time these new types of miners' lamps have been in use.

The advantages of electric blasting in reducing explosives accidents are being recognized by more general adoption of this safer method.

SUMMARY AND CONCLUSIONS

Under a safety plan granting premium credits for safety work, there is an unusual incentive to try to get results in safety achievement.

1. In California, from 1931 to 1935, the number of persons trained in first-aid work increased 800 percent.

2. Four up-to-date mine rescue-stations have been equipped.

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3. A slight reduction has occurred in accident frequency and severity rates.

4. Following the adoption of the safety plan the use of head protection has become the rule rather than the exception.

5. Electric blasting is gaining a foothold in the metal mines.

6. Recognizing the hazards in connection with open lights in blasting operations and as a cause of mine fires, electric cap lamps have been installed at two of the largest mines.

7. In 1935 there was a direct saving to the industry of $54,000 in industrial insurance premiums, through credits given for 100-percent first-aid training.

What is possible at one mine is possible, at least in part, at all mines, as the following experience shows: At one mine the insurance rate was $14.20 per $100 of pay roll, and industrial insurance cost this mine about $6,000 per month. The first-aid discount of 5 percent alone at this mine, based on the base rate, amounted to $225 per month for 1 year, which so far in 1936 is enough to pay the entire year's salary of the Bureau of Mines instructor, who did the training in 3 weeks.

The ultimate effect of this accident-prevention program is not yet apparent, and definite figures as to state-wide benefits probably will be lacking until a larger percentage of the mines and the workers come into line with the safety program. In individual mines the good effects are apparent in numerous instances, and as these instances increase the entire industry will unquestionably be benefited.